

# ON-LINE GAS/LIQUID CHROMATOGRAPHY

**MOVING FROM  
PIPELINE TO  
PROCESS  
APPLICATIONS**

- HIGHER RELIABILITY
- LOWER MAINTENANCE
- “OUT-OF-BOX” STARTUP



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**DANIEL**



# Daniel On-Line Gas Chromatographs for Pipeline and Process Applications...



Daniel Industries Houston headquarters

## 60 years of industry leadership

Headquartered in Houston – a strategic location for the extensive Gulf Coast hydrocarbon process industry – Daniel also manufactures in Scotland and supplies field support from offices in Canada, Singapore, and the Middle East, and has agents and representatives in over fifty countries.



Daniel GC's must pass a rigid operational test with on-line calibration standards in environmental chambers at temperatures from 0° to 130°F. Daniel dependability results from our dedication to in-house testing and quality control.

## The best combination of advanced technology and rugged instrumentation to help you make the most of your existing manpower

Today's trend toward downsizing means instrument technicians have more to do, and less time to do it. Instrumentation has to be more reliable and easier to use than ever before. Daniel gas chromatographs are your best choice.

## Superior technology and service life

- To meet Daniel's higher performance standards, our GC technology is developed in-house
- GC valves – 5 million injections between rebuilds
- Micro-packed columns – improve baseline separation, reduce carrier consumption, faster analysis
- Advanced applications with single or dual detectors
- Software and electronics – virtually unlimited chromatogram storage and diagnostic tools with laptop/PC
- Superior transient protection in controller
- Improved Modbus communications

## Higher reliability and lower maintenance Ready to use, right "out of the box"

Daniel has produced the highest quality chromatographs for decades. Quality control is the key to our success...and the reason for our chromatographs' reputation for ease-of-use, accuracy and dependability.

Our in-house environmental testing is the most thorough in the industry. Daniel gas chromatographs must endure our walk-in environmental test chambers – cycling between 0° and 130°F for up to 72 hours.

The result? Out-of-box start-up and years of reliable operation.



## Model 575 - For transportable, on-line and laboratory use

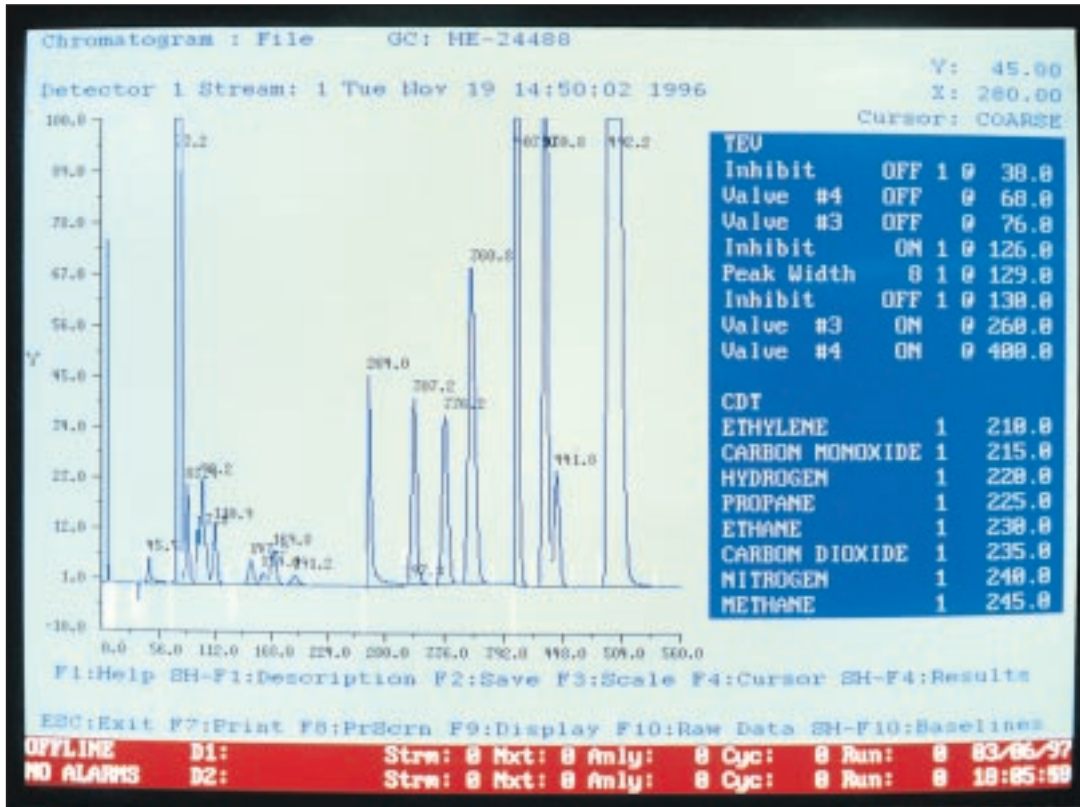
The Danalyzer Gas Chromatograph is packaged in a laboratory version with an integral 2350 controller. Laptop interface makes this versatile GC ideal for use in the lab or in the field.

Our chromatograph technology is packaged and applied differently with three types of detectors and two different oven designs. All Daniel chromatographs share a common operational technology so plant and laboratory personnel work on the same operating system.

Our advanced microprocessor-based electronics and software eliminate the need for expensive portable service panels and strip chart recorders.

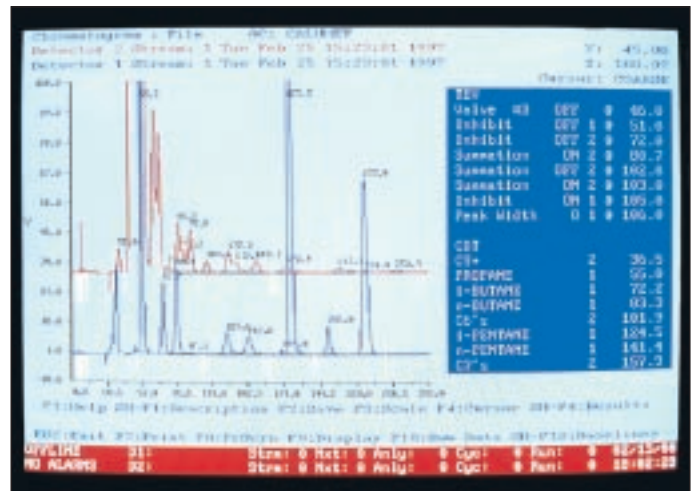
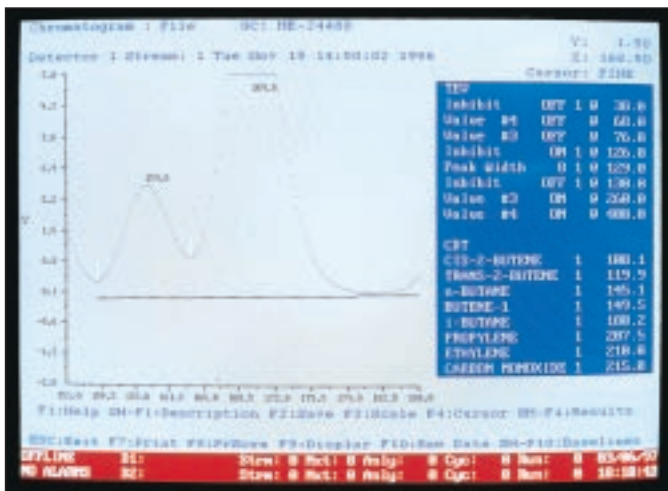
Daniel chromatographs simply require a laptop/PC for diagnostics at the chromatograph, in the control room, or offsite, to control all functions (optional keypad available). Advanced zoom features and chromatogram overlay provide resolution for advanced diagnostics and allow troubleshooting from any location. Technicians can recall current and historical chromatogram overlays for easy comparison.





**Powerful and flexible**

- Last run, current run, last calibration chromatogram stored in GC
- Extensive memory to store and recall historical chromatograms in PC
- Fixed time or auto slope detection for peak integration
- Hot-key shortcuts to raw data, analysis results, and other data directly from chromatogram screen
- Ticks downward for timed events, ticks upward for peak integration



**Simplified troubleshooting**

- Zoom functions allow troubleshooting with resolution to 25 milliseconds for any stored chromatogram
- Timed events, peak integration parameters, and chromatograms presented on one screen for editing
- High resolution zoom to individual data-base points displayed in relation to base line

**Chromatogram overlays for trouble-shooting and calibration**

- Last calibration/initial calibration overlay
- Virtually unlimited possibilities for advanced troubleshooting and analysis
- Simplifies troubleshooting for inexperienced technicians

# Superior Technology

## Chromatograph Valves

Daniel 6-port and 8-port valves, unique to the GC market, have greatly extended service life. This comes from minimum internal movement – about 1/10,000 inch, which also contributes to rapid operation. Flow paths for the sample are arranged so internal moving parts never contact the sample flow. As a result, abrasive mechanical wear on machined valve surfaces is eliminated. This unique double diaphragm design eliminates all springs, O-rings, and the need for lubrication.



Daniel ultra-long-life valves and micro-packed columns are key to superior chromatography, and higher reliability.

Daniel chromatograph valves can be operated over 5 million times without maintenance in most process applications – *reliability five to twenty times the stated reliability of competitive valves in similar service!* For most applications, chromatograph valves are warranted for life.

## Micro-packed columns

Since 1980, Daniel has been refining and improving its process for creating *micro-packed* columns.

Daniel micro-packed columns offer a superior combination of the features found in both capillary and conventional packed columns. The result is improved chromatography with extended column life – *several years* in most applications without measurable degradation or bleed. Daniel micro-packed columns produce sharper peaks for improved component separation, short analysis time, and very low carrier-gas consumption.



The inset photo shows the micro screen inserted at each end of a column to retain uniform packing in columns up to 9 feet long.

## Detectors

Daniel Process GC's incorporate three types of detectors:

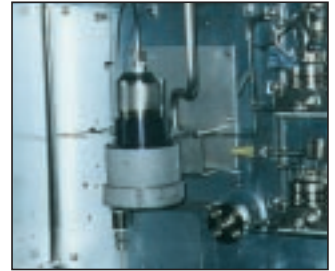
- TCD (Thermal Conductivity Detector)
- FID (Flame Ionization Detector)
- FPD (Flame Photometric Detector)

Each type of detector is mounted in a precision assembly which maintains uniform flow paths to minimize dead volume. Single or dual detector TCD's are generally used for analyzing higher concentrations, FID's for trace concentrations of hydrocarbons, and FPD's for trace sulphur analysis.

The TCD used will tolerate loss of carrier for extended time periods without damage.



TCD (Thermal Conductivity Detector)



FID (Flame Ionization Detector)



Photo courtesy of Finnigan Corp.

FPD (Flame Photometric Detector)



## 2350 Controller - Advanced Software

The ability to monitor dual detectors simultaneously opens up new applications with greater speed. Applications such as natural gas extended analysis (C<sub>1</sub> + C<sub>9</sub> in five minutes) or natural gas with helium are all now possible. The primary benefit is faster analysis times for many on-line applications.

Recorders are not necessary; laptops can be used as the primary interface to allow for almost unlimited chromatogram storage and retrieval. Optional printers can be serial or the less-expensive, easier-to-install parallel type.

## Applications

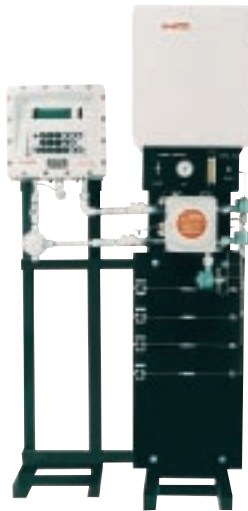


### 2350 Chromatograph Controller

Used with all Daniel GC's and available in various mounting configurations as noted below.

The 2350 is designed to minimize engineering, training, and effort in measurement accounting. It mounts in a 19" rack, as a 2251 retrofit, or in an explosion proof NEMA 4X enclosure and can control up to 12 streams. The Model 2350 offers four independent Modbus serial ports plus a

parallel printer port. Two analog outputs are standard and can be expanded to 10. An optional keyboard/display and internal modem is available for local or remote diagnostics (PC). Plug in transient protection modules meet the highest European standards for electrical protection.



Danalyzer gas chromatograph with integral X-proof controller.

### DANALYZER The Pipeline BTU Chromatograph

The Danalyzer Gas Chromatograph is installed for custody transfer measurement on more pipelines worldwide than all competitive units combined. The weatherproof/X-proof design makes the Danalyzer GC temperature tolerant from -17° to 55°C (0° to 130°F) for outdoor installations.

The large data archive stores the last 1200 analyses, 400 calibrations and 64 variables for averaging and trending.

The Danalyzer GC offers fast four minute analysis time with complete baseline separation of all components, improving peak integration for critical nitrogen, methane, and carbon dioxide measurement. This superior component measurement improves the final BTU calculation, with repeatability to ± 0.5 BTU's in 1000 without ambient temperature control. A temperature controlled environment with weekly calibrations improves analyzer performance to ± 0.25 BTU's per 1000! All diagnostics and configuration, including chromatograms, can be accessed locally or from a remote location via modem.

- DETECTOR(S):** TCD (Single or Dual)
- OVENS:** Heat Sink (no air required)
- CONTROLLER:** Separate (19" rack, panel mount, or X-proof)
- AREA CLASS:** Class 1, Div 1, Groups C, D



Typical outdoor installation in U.S. Gulf Coast region.



Model 500 with lower sample system oven

### Models 500 and 1000 for the process industry.

Models 500 and 1000 are the same basic Danalyzer technology.

#### MODEL 500

The 500 series uses a heat sink oven at temperatures up to 85°C (185°F) and accepts up to 12 streams of liquids or gases.

- DETECTOR(S):** TCD (Single or Dual)
- OVENS:** Heat Sink (no air required)
- CONTROLLER:** 19" rack, panel mount, or X-proof (integral or separate)
- AREA CLASS:** Class 1, Div 1, Groups C, D (group B with air purge)



Model 1000 with lower sample system oven

#### MODEL 1000

The 1000 series offers increased application flexibility including a choice of 3 detectors for sulphur compounds and low-level hydrocarbon concentrations. The conventional air bath oven operates up to 150°C (300°F) to vaporize heavier hydrocarbons and accepts up to 12 streams of liquids or gases.

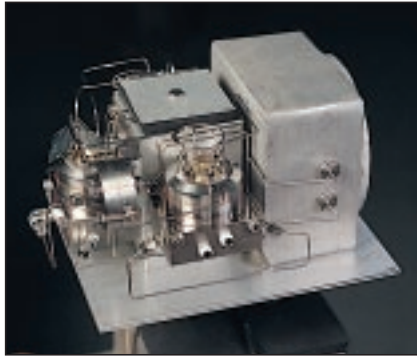
- DETECTOR(S):** TCD, FID, FPD, Dual TCD
- OVENS:** Conventional Air Bath
- CONTROLLER:** 19" rack, panel mount, or X-proof (integral or separate)
- AREA CLASS:** Class 1, Div 1, Groups C, D standard X or Z purge required for Div 1 or 2, Group B



## Ovens

Daniel offers two choices in analytical oven design for its chromatographs:

- Heat sink
- Conventional air bath



### The Heat Sink Oven

Installed in thousands of units worldwide, the Heat Sink oven integrates a TCD, micro-packed columns, and GC valves in a single temperature-controlled assembly.

The entire oven is electrically approved for Class 1,

Div 1, Groups C and D without the need for instrument air, for oven heat, or for safety reasons.

This unique oven design, with heat up to 85°C (185°F), is standard in the Danalyzer, Laboratory and Model 500 Process GC's.



### The Air Bath Oven

The Air Bath oven uses a conventional instrument air-heater design. It is supplied in the Model 1000 Process GC for applications requiring heat up to 150°C (300°F) and/or FID, FPD, or TCD detectors. Dual TCD's or

a combination of a TCD and FID can be mounted internally.

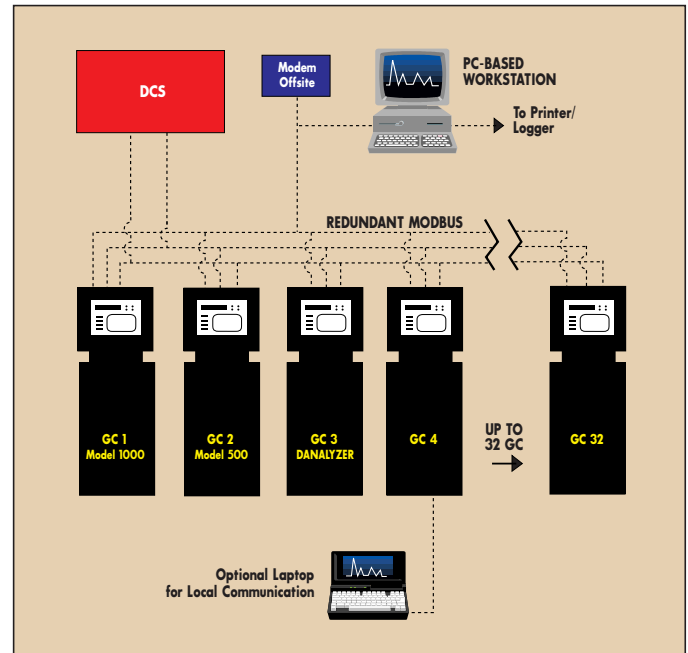
## Configuration

Daniel GC's offer the ultimate in configuration flexibility:

- Auto setup for critical valve timing lets GC establish its own correct timing for chromatograph valves
- Configurable baseline check included with autocal
- Up to 12 streams with four sets of timed events and four sets of calibration tables
- Edit component tables and timed events directly from chromatograph screen
- View raw data and analysis results
- Laptop/PC storage of all GC applications

## Communications

Field-configurable versions of Modbus communication protocols provide for direct DCS interfacing. Provisions for these versions are integrated into the GC controller firmware. Four serial ports accommodate redundant data highways and chromatograph diagnostics directly from the chromatographs without the expense of additional service panels or work stations. GC diagnostic software is included in the initial cost and operates on conventional laptops/PC's for use at the central PC based workstation, or at the chromatograph.



*Simplified DCS interfacing. Integrated firmware handles various implementations of Modbus protocol. Multiple serial ports can be field configured to provide redundant modbus data highways.*

- Simple DCS interfacing; serial communications up to 19.2 K baud on four independent ports (RS-232, RS-422, and/or RS-485).
- All data, including chromatograms, can be uploaded or downloaded by local or offsite communications via modem.

## Trending

Multiple trending screens make comparisons easy. Dual-component historical trending (for example C<sub>2</sub>/C<sub>3</sub> ratio trends) provides valuable information to system users. Averages are fully configurable with up to 64 variables.

- The last 1200 analyses are saved in the GC controller for trending any analytical calculation.
- The last 400 calibrations are saved in the GC controller.

## Safety

Daniel chromatographs are designed to minimize personnel exposure to process media. The versatile software and communications capabilities make possible full-function remote diagnostics to greatly reduce plant service or trips "to the field".

## 2350 CONTROLLER

<b>Power:</b>	115 VAC ±15% @ 0.55 Amps, 50/60 Hz 230 VAC ±15% @ 0.275 Amps, 50/60 Hz 63.25 VA power consumption without current outputs
<b>Transient Protection:</b>	C.E. tested & certified to highest levels (3 & 4) of IEC 801 STD.
<b>Environment:</b>	Operating range @ -17 to 55°C (0 to 130°F) Storage range -40 to 85°C (-40°F to 185°F) Humidity @ 0-95% RH (non-condensing)
<b>Dimensions:</b>	19" rack size: 22.5cm H x 48.5cm W x 24.13cm D (8.75"H x 19"W x 9.5"D)  Panel retrofit size: 21.5cm H x 28cm W x 23cm D (11"H x 8.5"W x 9"D)  X-proof size: 29.5cm H x 33cm W (11.5"H x 13"W)
<b>Approximate Weight:</b>	19" rack size: 11.34 kg (25lbs.) Panel retrofit size: 9.98 kg (22 lbs.) X-proof size: 27.21 kg (60lbs.)
<b>Area Classification:</b>	Rack and panel mount – General Purpose X-Proof Class 1, Div 1, Groups C, D Integral controller with GC – suitable for Class 1, Div. 1 or Div. 2, Groups B, C, or D with X purge or Z purge per NFPA 496

## INPUT/OUTPUT

<b>Analog Inputs:</b>	8 4-20mA filtered with transient protection
<b>Analog Outputs:</b>	2 4-20mA standard, optional 4 or 8 more (software calibrated)
<b>Digital Inputs:</b>	1 GC common alarm, optically isolated with transient protection 5 user assignable alarms, optically isolated with transient protection
<b>Digital Outputs:</b>	5 open collector, optically isolated with transient protection
<b>Detector Inputs:</b>	TCD, FID, and FPD Single or dual detector inputs
<b>Communications Ports:</b>	4 field-configurable Modbus ports, RS-232, 422, or 485. (Max RS-422 ports is 2)
<b>Optional Modem:</b>	Internal or external telephone modem 300 baud to 9600 baud
<b>Optional Keyboard/LCD Display:</b>	18 buttons / 8 lines x 41 characters (Eliminates need for laptop)

## SYSTEM CONFIGURATION

<b>Memory:</b>	1 megabyte standard for storage of last 400 calibrations and last 1200 analyses Memory expandable to 4 megabytes for averages with optional memory board
<b>CPU:</b>	NEC V-53
<b>Chromatogram Storage:</b>	Last run and last calibration for each method
<b>Methods:</b>	4 timed events, 4 component tables
<b>Number of Streams:</b>	12
<b>Gating Options:</b>	Fixed-time Auto, Slope detection and peak identification on all peaks in predetermined window

## DANALYZER, MODEL 500, AND LAB GC

<b>Power:</b>	115 VAC ±15%, 220 VAC ±15%, 50/60 Hz 100 watts running, 350 watts startup
<b>Environment:</b>	-17 to 55°C (0 to 130°F)
<b>Dimensions: (w/o sample system):</b>	Danalyzer – 165cm H x 41cm W x 53.5cm D (65"H x 16"W x 21"D) Model 500 – 154cm H x 51cm W x 53.5cm D (65"H x 20"W x 21"D) Lab GC – 25.4cm H x 74cm W x 56cm D (10"H x 29"W x 22"D)
<b>Approximate Weight (w/o sample system):</b>	Danalyzer – 56.69 kg (125 lbs.)* Model 500 – 36.28 kg (90 lbs.) Lab GC – 31.75 kg (70 lbs.) * Includes sample system mounted on lower plate
<b>Area Classification:</b>	Danalyzer and Model 500 – Class 1, Div 1, Groups C, D (no air)* Lab GC – General purpose * Group B with air purge
<b>Mounting:</b>	Free-standing or wall mount
<b>Columns:</b>	1/16" micro-packed
<b>Oven:</b>	Heat sink, max 85°C (185°F)
<b>Valves:</b>	Daniel 6-port, 8-port, other 4-port for liquid sample injection
<b>Carrier Gas:</b>	Zero-grade helium, nitrogen or hydrogen @ 90 psig

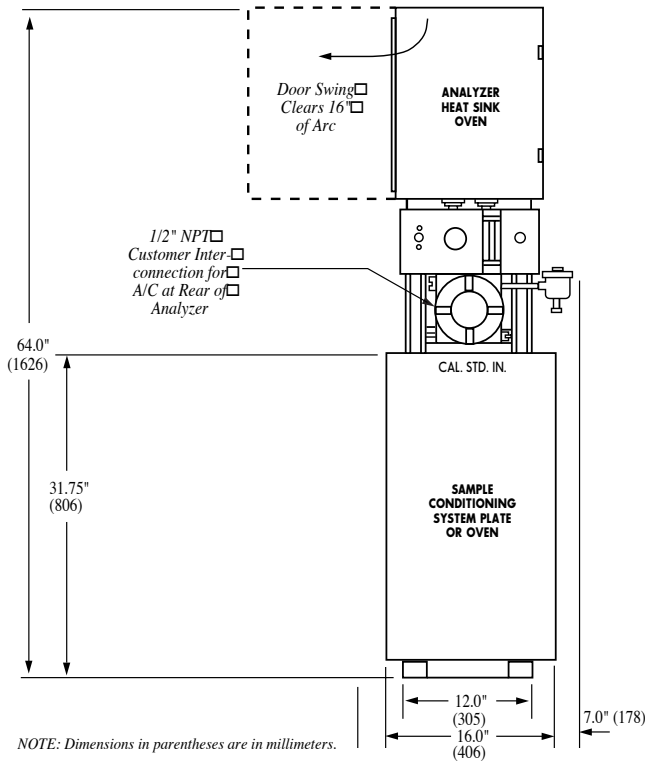
## MODEL 1000

<b>Power:</b>	115 VAC ±15%, 220 VAC ± 15%, 50/60 Hz 400 watts running, 1100 watts startup
<b>Environment:</b>	0 to 55°C (32 to 131°F) for T.C.D. and F.I.D. 20°C ± 5°C (70°F ± 10°F) for F.P.D.
<b>Dimensions: (w/o sample system):</b>	198cm H x 61cm W x 61cm D (78"H x 24"W x 24"D)
<b>Approximate Weight (w/o sample system):</b>	68 kg (150 lbs.)
<b>Area Classifications:</b>	Class 1, Div 1, Groups C, D (X-proof, no purge) Class 1, Div 1, Groups B, C, D (X purge) Class 1, Div 2, Groups B, C, D (X or Z purge)
<b>Mounting:</b>	Free-standing or wall mount
<b>Columns:</b>	1/16" micro-packed, 1/8" packed, or Capillary
<b>Oven:</b>	Air bath, max 150°C (302°F)
<b>Valves:</b>	Daniel 6-port, 8-port, other 4-port for liquid sample injection
<b>Carrier Gas:</b>	Zero-grade helium, nitrogen or hydrogen
<b>Instrument Air:</b>	Flow – 4 SCFM for oven heat @ 40 psig Pressure – 90 psig for valves (40 psig option with valve actuation from carrier gas)

## TYPICAL OUTLINE AND DIMENSIONS

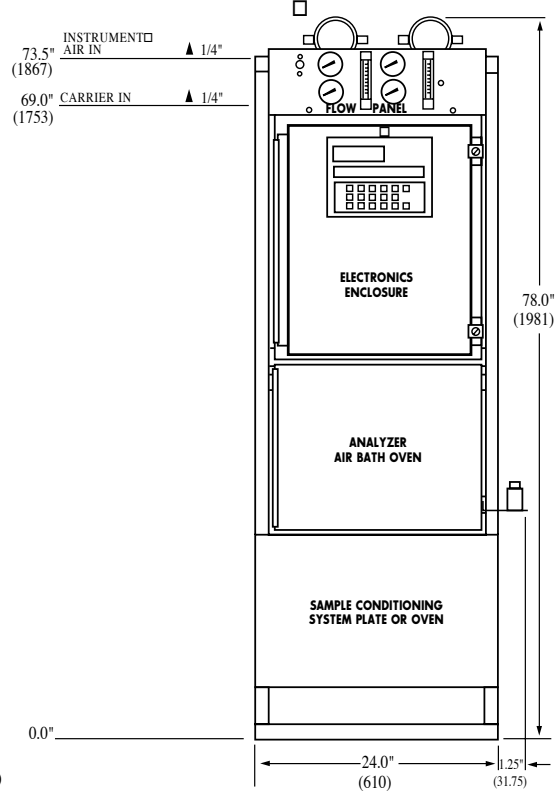
### DANALYZER AND MODEL 500

Front View  
Without Sample System Oven



### MODEL 1000

Front View



# DANIEL

### Daniel Measurement and Control

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